1981

Water-Resources Studies in Utah July 1, 1980 to June 30, 1981

United States Geological Survey

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES STUDIES IN UTAH

JULY 1, 1980, TO JUNE 30, 1981

Compiled by Linda S. Hamblin and Joseph S. Gates

U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 81-903

Salt Lake City, Utah
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WATER-RESOURCES STUDIES IN UTAH

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INTRODUCTION

This report summarizes the progress on water-resources studies in Utah by the U.S. Geological Survey during the period July 1, 1980, to June 30, 1981. Much of the work was done in cooperation with the State of Utah or local agencies. Additional supporting funds were transferred from other Federal agencies or appropriated directly to the Geological Survey.

The State and local cooperators were:

Utah Department of Natural Resources and Energy
- Division of Water Rights
- Division of Water Resources
- Division of Wildlife Resources
- Geological and Mineral Survey

Bear River Commission
Utah Department of Transportation
Salt Lake County
Salt Lake County Division of Flood Control and Water Quality
Central Utah Conservancy District
Lower Gunlock Reservoir Corporation

The Federal cooperators were:

Bureau of Land Management
Bureau of Reclamation
Environmental Protection Agency
Federal Power Commission
Corps of Engineers

The program in Utah at the end of the reporting period consisted of 26 projects, and a discussion of each project is given in the following pages. Short descriptions are given at the end of the report for four proposed projects to be started on or after July 1, 1981.

In addition to the 30 projects mentioned above, work is being completed on reports for two other projects. The status of the reports is as follows:

UT 117 "Reconnaissance of geothermal resources of Utah." In press as U.S. Geological Survey Professional Paper 1044-H.

UT 137 "Ground-water reconnaissance in the Morgan Valley - Henefer Valley - Coalville area, Morgan and Summit Counties, Utah." In review.

THE FOLLOWING REPORTS WERE RELEASED TO THE OPEN FILE:

Hydrologic and climatologic data, southeastern Uinta Basin, Utah and Colorado, water year 1978: U.S. Geological Survey Open-File Report 80-1025 (duplicated as Utah Hydrologic-Data Report 34).

Hydrologic monitoring in coal fields of central Utah, August 1978-September 1979: U.S. Geological Survey Open-File Report 81-138.

Preliminary hydrologic evaluation of the North Horn Mountain coal-resource area, Utah: U.S. Geological Survey Open-File Report 81-141.

Hydrologic studies of the U.S. Geological Survey in major coal-resource areas of Utah: U.S. Geological Survey Open-File Report 81-126.

Ground-water data for the Beryl-Enterprise area, Escalante Desert, Utah: U.S. Geological Survey Open-File Report 81-340 (duplicated as Utah Hydrologic-Data Report 35).

Hydrology of the Ferron Sandstone aquifer and effects of proposed surface-coal mining in Castle Valley, Utah: U.S. Geological Survey Open-File Report 81-535.

Hydrology of the Beryl-Enterprise area, Escalante Desert, Utah, with emphasis on ground water: U.S. Geological Survey Open-File Report 81-533.

Digital-computer model of the principal ground-water reservoir in the Beryl-Enterprise area, Escalante Desert, Utah: U.S. Geological Survey Open-File Report 81-532.

Hydrology of the coal-resource areas in the upper drainages of Huntington and Cottonwood Creeks, central Utah: U.S. Geological Survey Open-File Report 81-539.

Selected biological characteristics of streams in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Open-File Report 81-644.

THE FOLLOWING REPORTS WERE PUBLISHED:

Geochemistry of spring water, southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Supply Paper 2074.

Summary appraisal of water resources in the Redmond Quadrangle, Sanpete and Sevier Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1304-B.

Map showing general chemical quality of surface water in the Richfield Quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1234.

Map showing general chemical quality of surface water in the Alton-Kolob coal-fields area, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1235-A.

Map showing general chemical quality of ground water in the Alton-Kolob coal-fields area, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1235-B.

THE FOLLOWING REPORTS WERE PUBLISHED—Continued

Surface-water resources in the Tooele 2° Quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1245.

Seepage study of the West Side-West Canal, Box Elder County, Utah: Utah Department of Natural Resources Technical Publication 67.

Ground-water conditions in Tooele Valley, Utah: Utah Department of Natural Resources Technical Publication 69.

Ground-water conditions in Utah, spring of 1980: Utah Division of Water Resources Cooperative Investigations Report 19.

Estimated inflow and evaporation for Great Salt Lake, Utah, 1931-76, with revised model for evaluating the effects of dikes on the water and salt balance of the lake: Utah Division of Water Resources Cooperative Investigations Report 20.

A three-dimensional digital-computer model of the Ferron Sandstone aquifer near Emery, Utah: U.S. Geological Survey Water-Resources Investigations 80-62.

Results of test drilling for ground water in the southern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations 80-951.

Water resources data for Utah, water year 1979: U.S. Geological Survey Water-Data Report UT-79-1.

The Navajo Sandstone - A regional aquifer: in Henry Mountains Symposium, Utah Geological Association Publication 8.

CURRENT PROJECT

Title and Number: COLLECTION OF BASIC RECORDS - SURFACE WATER; UT 00-001-FOICL

Cooperating Agencies: U.S. Bureau of Reclamation; U.S. Corps of Engineers; U.S. Bureau of Land Management; Federal Power Commission; Utah Division of Water Rights; Utah Division of Water Resources; Bear River Commission; Salt Lake County; Central Utah Conservancy District; Lower Gunlock Reservoir Corp.

Staff: R. W. Cruff, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objective: To obtain data on stream discharge or stage and reservoir or lake stage at selected sites throughout Utah.

Approach: Standard methods for the operation and maintenance of gaging stations and for the computation of streamflow records were used.

Progress: Field and office work necessary for the publication of records for 232 streamflow stations, 17 reservoirs, and 3 lake-stage stations continued during the year. The stations are classified as follows:

Current purpose or project related	158
Hydrologic	58
Benchmark or long-term change	12
Regulated	4
Reservoirs (long-term management)	17
Lake stage	3

Gaging stations started were:

Montezuma Creek at golf course, at Monticello
North Creek above ranger station, near Monticello

Gaging stations discontinued were:

Salt Creek at Nephi
Twelvemile Creek near Mayfield
Little Creek near Paragonah
Indian Creek Tunnel near Monticello
San Pitch River near Sterling
Williard Bay Reservoir near Plain City
Centerville Creek above diversions, near Centerville
Panguitch Creek near Panguitch
Otter Creek above reservoir, near Antimony
Hyrum Reservoir near Hyrum

Logan River below Blacksmith Fork, near Logan
Malad River near Plymouth
Hammond (East Side) Canal near Collinston
West Side Canal near Collinston
Pine Creek near Bicknell
Muddy Creek at mouth, near Hanksville

Plans for Next Year: Continue operation of network. Prepare 1981 water-year records for publication.

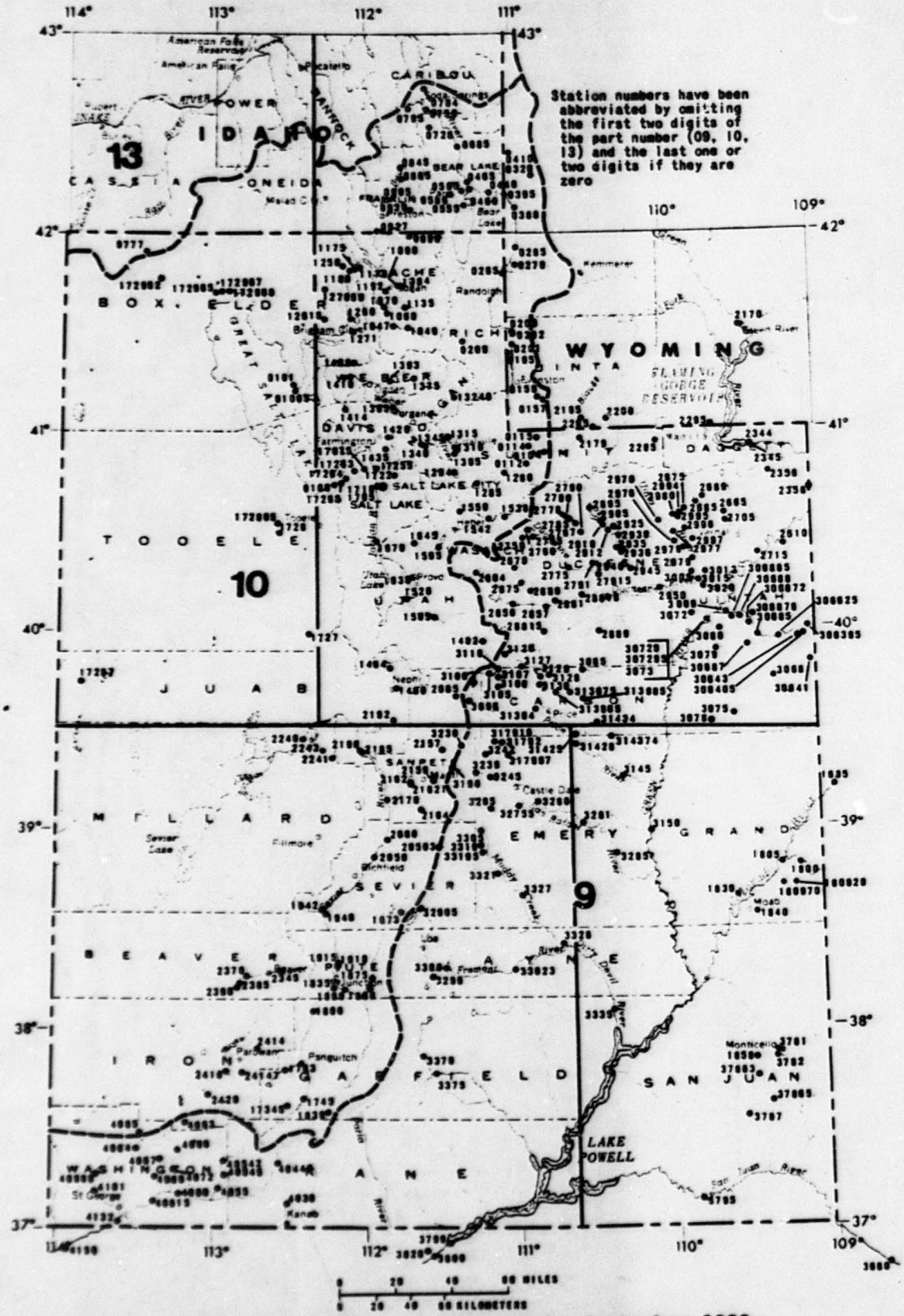
Reports:

Water resources data for Utah, water year 1979, U.S. Geological Survey Water-Data Report UT-79-1.

Water resources data for Utah, water year 1980: U.S. Geological Survey Water-Data Report UT 80-1 (in press).

"Streamflow and reservoir contents in Upper Colorado River Basin" is issued monthly.

"Streamflow and reservoir contents—Utah" is issued monthly December-May.



Location of gaging stations in Utah, September 1980.

CURRENT PROJECT

Title and Number: COLLECTION OF BASIC RECORDS-GROUND WATER; UT-00-002-FC

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Wildlife Resources;
Utah Department of Transportation

Staff: L. R. Herbert, Project Chief (part time)
M. E. Smith, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: Continuing

Objective: To obtain long-term data on ground-water levels throughout the State and determine water-level trends in selected areas.

Approach: Standard methods for the observation, recording, and reporting of water levels were used.

Progress: Water-level measurements were made semiannually in about 700 wells, and continuous water-level data were obtained by recorders at 37 wells as part of the Statewide observation-well network. Continuous records of discharge were obtained at four springs. Approximately 1,000 wells were measured during February-March for the preparation of annual water-level-change maps.

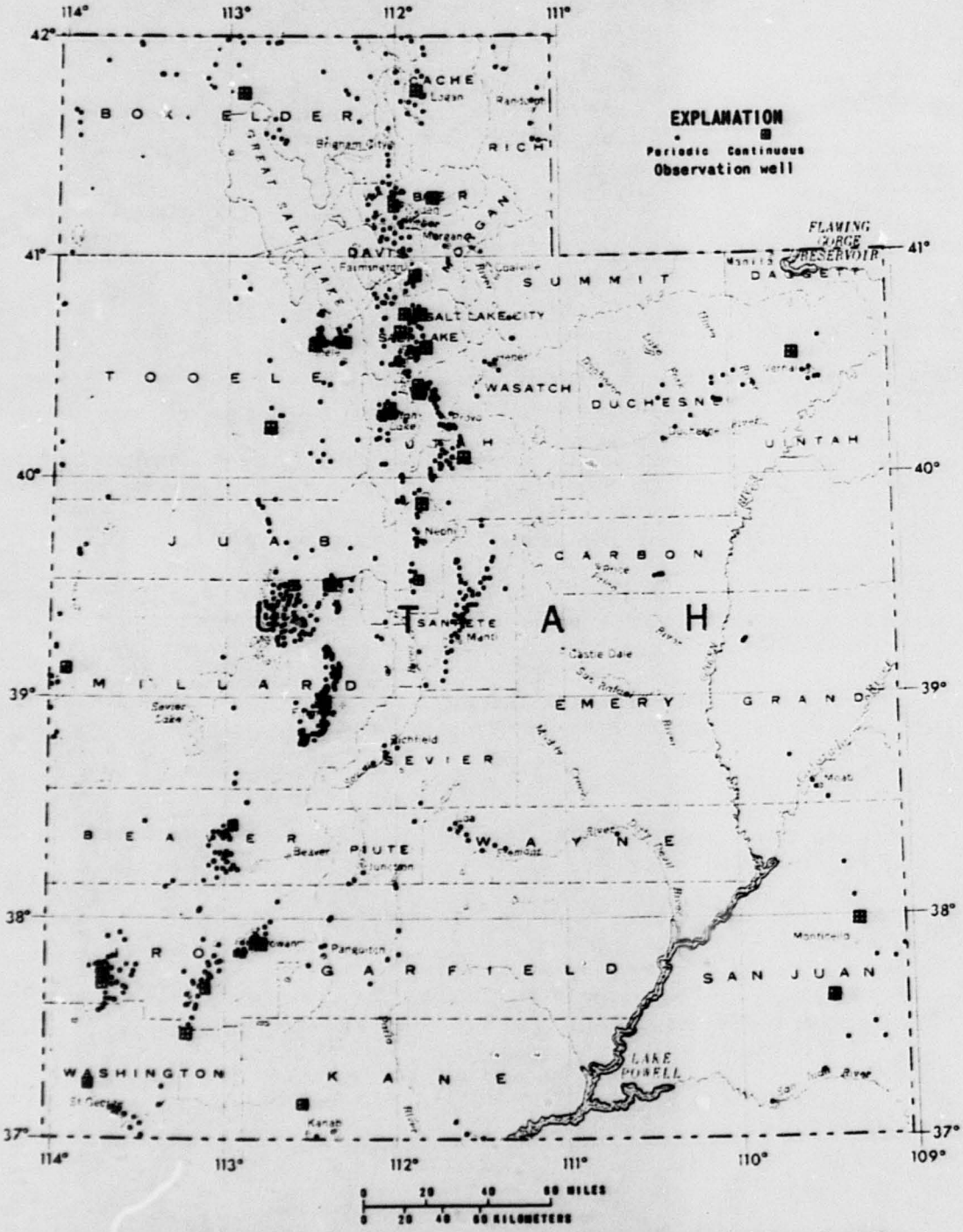
Plans for Next Year: Continue operation of the network of observation wells and measurement of spring discharge. Prepare records for publication.

Reports:

Water resources data for Utah, water year 1979, U.S. Geological Survey, Water-Data Report UT-79-1.

Water resources data for Utah, water year 1980: U.S. Geological Survey Water-Data Report UT-80-1 (in press).

Water-level-change maps, February or March 1981 (for 15 areas in Utah). (Issued April 1 as local press releases and distributed to interested individuals.)



Location of observation wells in Utah where ground-water levels were measured.

CURRENT PROJECT

Title and Number: COLLECTION OF BASIC RECORDS - QUALITY OF WATER; UT 00-003-FOIC; and SEDIMENT, UT 00-004-FOIC

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Water Resources;
Utah Division of Wildlife Resources;
Utah Geological and Mineral Survey;
U.S. Bureau of Land Management;
U.S. Environmental Protection Agency;
U.S. Bureau of Reclamation

Staff: R. W. Cruff, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objective: To obtain long-term records of the quality of water at selected stream sites, springs, and wells in Utah and to obtain shorter-term records for use by other Federal or State agencies involved in development of water resources or environmental protection.

Approach: Standard methods for the collection and analysis of chemical-quality and fluvial-sediment samples were used.

Progress: Data on the quality of surface water were collected at 41 sites in Utah. Daily chemical-quality records were collected at 16 stream sites and periodic chemical-quality records at 21 stream sites. Data on the specific conductance of surface water were obtained at an additional 194 stream-gaging stations in Utah. Daily sediment records were collected at 5 sites and periodic sediment records at 16 sites. Daily water-temperature data were obtained at 16 sites and monthly temperature data at 194 sites. Data on the quality of ground water were collected at about 320 wells in Utah.

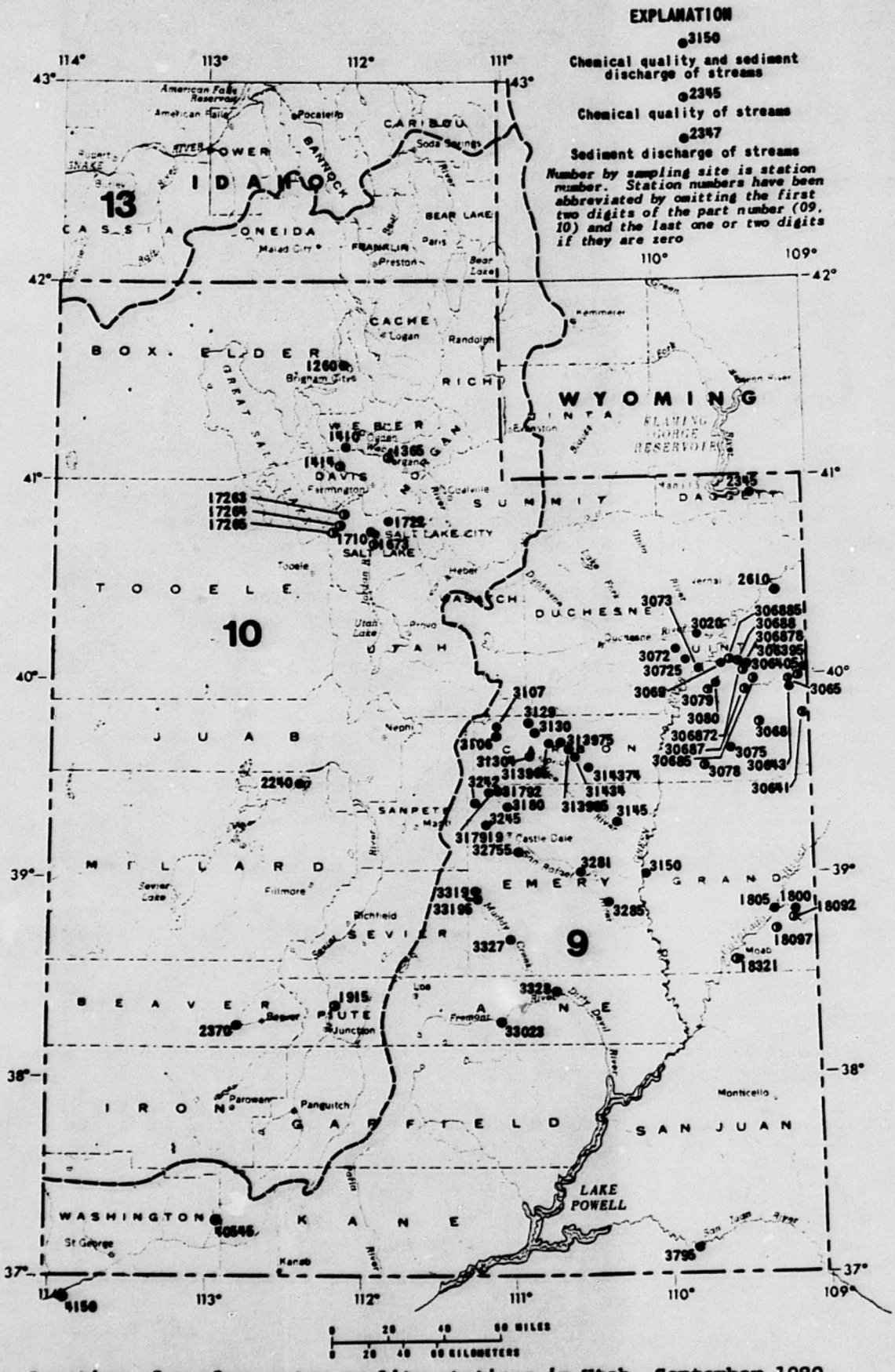
All water-quality records for inclusion in "Water Resources Data for Utah, 1980" were completed and photocopy was prepared.

Plans for Next Year: Continue field-data collection and records processing and preparation of records for publication.

Reports:

Water resources data for Utah, water year 1979: U.S. Geological Survey Water-Data Report UT-79-1

Water resources data for Utah, water year 1980: U.S. Geological Survey Water-Data Report UT-80-1 (in press).



Location of surface-water quality stations in Utah, September 1980.

CURRENT PROJECT

Title and Number: STATEWIDE WATER USE;
UT 78-007-C

Cooperating Agency: Utah Division of Water Rights

Staff: R. W. Cruff, Project Chief (part time)
D. Hooper, Utah Division of Water Rights
R. Schwarting, Utah Division of Water Rights
Other State personnel as assigned

Period of Project: Began July 1977, continuing

Objectives: To obtain Statewide information about withdrawals and return flows of water for various uses and consumptive use of water in connection with each type of withdrawal.

Approach: Field inventory of surface-water diversions and some types of ground-water diversions, acreage and crop surveys, refinement and application of all data necessary to determine consumptive use.

Progress: Approximately 100 public water-supply facilities were visited and evaluated during the summer and fall of 1980. About 20 discharge measurements were made during these visits. Revised and reprinted public-information bulletin. Approximately 50 percent of 1979 data collected were revised and resubmitted to the State data-retrieval system. Added about 150 public-water suppliers to annual survey of 1980. Vibration-time totalizers (VTT's) were installed on 25 irrigation wells in the Milford area. Survey forms developed and sent to approximately 150 self-supplied industries. Estimations made on water use for all categories of users in State for 5-year report. The 1960-78 water-use report was revised, published, and sent to 320 public-water suppliers.

Plans for Next Year: E-cells on installed VTT's will be changed monthly. The States biggest self-supplied industries will be visited and evaluated. Continue to visit public-water suppliers, evaluating water rights and possible distribution improvements. Revise computer program and submit data to National water-use data base in Reston. Water-use report for 1979 will be completed. Report will be written on results of VTT testing.

Reports:

Utah Division of Water Rights, 1981, Utah water use data, public-water supplie', 1960-78, Utah Department of Natural Resources, Utah Water Use Report 1, 250 p.

Title and Number: GROUND-WATER CONDITIONS IN UTAH; UT 64-046-C

Cooperating Agency: Utah Division of Water Resources

Staff: J. S. Gates, Project Chief (part time)
L. R. Herbert, Editor (part time)
Other editors as assigned prior to fiscal year 1980 (part time)
Don Price, Hydrologist (part time)
Other District personnel as assigned

Period of Project: Began July 1963, continuing

Objective: To determine changing ground-water conditions in Utah, including status of development.

Approach: The State includes areas of major and minor ground-water development. Data and interpretation are most detailed and control most adequate for the areas of major development. Interpretations for the areas of minor development are based on relatively few data. Each year, ground-water withdrawals for irrigation are estimated using annual ratings of pumps as to power used to pump a given quantity of water, ratings of flowing wells, and calculations based on pump ratings and electrical-power records. Estimates of ground-water withdrawals for public supply are based largely on data obtained by the Utah Division of Water Rights. Estimates for industrial use are obtained from users or by rating pumps and using power records. Water-level changes are determined from annual measurements, most of which are made in March. Also, records are kept of the number and sizes of new wells drilled in the State as determined from well drillers' reports to the Utah Division of Water Rights. The conditions in specific areas of major development are described in the annual report by the most knowledgeable person in the District. The project chief assigns work, and the editor coordinates the report preparation and prepares the annual summary statement.

Progress: Visits were made to approximately 500 wells during 1980, more than half of which were measured for discharge. The eighteenth in a series of annual reports that describe ground-water conditions in Utah was completed. The estimated total withdrawal of water from wells in Utah in 1980 was 762,000 acre-feet or about 98,000 acre-feet less than was reported for 1979 and about 44,000 acre-feet less than the average reported for 1970-79. The decrease from 1979 was due chiefly to decreased withdrawals for irrigation.

Plans for Next Year: Accumulation of data on water levels, ground-water withdrawals, and numbers of new wells constructed will continue as during the previous year. The nineteenth of this series of annual reports will be submitted in 1982.

Reports:

Herbert, L. R., and others, 1981, Ground-water conditions in Utah, spring of 1981: Utah Division of Water Resources Cooperative Investigations Report 21.

Title and Number: CANAL-LOSS STUDIES; UT 74-107-C

Cooperating Agency: Utah Division of Water Rights

Staff: R. W. Cruff, Project Chief (part time)
L. R. Herbert, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: Began July 1973, continuing

Objectives: To determine the amount of water lost by seepage from canals in irrigated areas throughout the State. This information will contribute to current and future cooperative areal investigations as well as to resolution of the problem of water allocations to the users.

Approach: Gaging-station and measuring sites are selected, based on a geologic reconnaissance of the canals. Seepage runs are made three to five times during an irrigation season. The seepage measurements are adjusted for fluctuations in stage of the canal during the course of each seepage run. Each set of canal studies spans a 2-year period.

Progress: The seepage measurements on the Central Utah, Leamington, and McIntyre Canals and the Sevier River near Leamington were completed. The data were analyzed and the report was prepared.

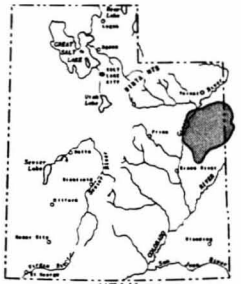
Plans for Next Year: Select a new set of canals for study, make a reconnaissance of the canals, install stage recorders, and begin making seepage measurements.

Reports:

Herbert, L. R., Cruff, R. W., and Holmes, W. F. (in review), Seepage study of the Sevier River and the Central Utah, McIntyre, and Leamington Canals, Juab and Millard Counties, Utah: Utah Department of Natural Resources and Energy Technical Publication.

CURRENT PROJECT

Title and Number: HYDROLOGY OF THE OIL-SHALE AREA, UINTA BASIN; UT 75-113-F



Cooperating Agencies: (for related basic-data collection only)
U.S. Bureau of Land Management;
Utah Department of Natural Resources and Energy

Staff: K. L. Lindskov, Project Chief (part time)
W. F. Holmes, Hydrologist (part time)
B. A. Kimball, Hydrologist (part time)
R. L. Seiler, Hydrologist (part time)

Period of Project: Began October 1974, continuing.

Objectives: Determine the availability of water in the southeastern part of the Uinta Basin and identify impacts oil-shale development may have on the water resources.

Approach: The study involves planning a data network, analyzing existing information, and collecting and analyzing additional information.

Progress: Monitoring continued at 18 streamflow sites and 1 well in alluvium. The streamflow monitoring included: flow—continuous; conductivity and temperature—continuous at three sites and monthly at others; common ions, nitrate plus nitrite and phosphate—quarterly; sediment—continuous at six sites and miscellaneous at others; and trace metals and biological sampling at selected sites. Water levels and water-quality information are obtained monthly for the well. The streamflow sites and the well are also included in sites listed under projects UT-001 and UT-002. All interpretive work planned for the first 6 years is complete. For the 15 reports listed below, 10 are published, 4 are in review and 1 is in preparation.

Plans for Next Year: Continue monitoring at the 18 streamflow sites and the 1 well. Complete processing of all reports.

Reports:

Butler, J. R., and England, J. L., 1979, Vegetation map of the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-1141.

Conroy, L. S., 1979, Hydrologic and climatologic data, southeastern Uinta Basin, Utah and Colorado, water year 1977: U.S. Geological Survey Open-File Report 79-1493 (also duplicated as Utah Hydrologic-Data Report 33), 193 p.

Conroy, L. S., 1980, Hydrologic and climatologic data, southeastern Uinta Basin, Utah and Colorado, water year 1978: U.S. Geological Survey Open-File Report 80-1025 (also duplicated as Utah Hydrologic-Data Report 34) 166 p.

Conroy, L. S., and Fields, F. K., 1977, Climatologic and hydrologic data, southeastern Uinta Basin, Utah and Colorado, water years 1975 and 1976: Utah Basic-Data Release 29, 244 p.

Holmes, W. F., 1979, Maps showing generalized structure contours on the tops of the Wasatch and Green River Formations, geologic sections, and contours of thickness of the Green River Formation, southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-1156.

Holmes, W. F., 1980, Results of test drilling for ground water in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations 80-951, 90 p.

Holmes, W. F., and Kimball, B. A. (in review), Ground water in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Supply Paper.

Hudson, H. H., 1976, Hydrologic studies in the oil-shale areas of Colorado, Utah, and Wyoming: U.S. Geological Survey Open-File Report.

Jurado, Antonio, and Fields, F. K., 1978, Channel migration of the White River in the eastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Miscellaneous Investigations Map I-1087.

Kimball, B. A., 1981, Geochemistry of spring water, southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Supply Paper 2074, 30 p.

Lindskov, K. L., and Kimball, B. A. (in review), Streamflow in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Supply Paper.

Lindskov, K. L., and Kimball, B. A. (in preparation), Water resources of and hydrologic effects of oil-shale development in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Professional Paper.

Naten, R. W., and Fuller, R. H., 1981, Selected biological characteristics of streams in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations 81-644.

Seiler, R. L., and Tooley, J. E. (in review), Erosion and sediment characteristics of the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations.

Waltemeyer, S. D. (in review), Selected climatic characteristics of the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations.

CURRENT PROJECT

Title and Number: WATER-RESOURCES MONITORING - CENTRAL UTAH COAL REGION; UT 77-129-F

Staff: G. G. Plantz, Project Chief (part time)
Other District personnel as assigned

Period of Project: Began August 1978, continuing

Objective: To determine the characteristics of the regional surface-water system and to detect and document changes in quantity and quality that may be associated with coal mining.

Approach: Evaluate the existing basic-data collection program for its regional surveillance value and add additional data sites or upgrade existing sites as needed. Evaluate the data as they are collected so that changes due to coal mining may be detected and documented.

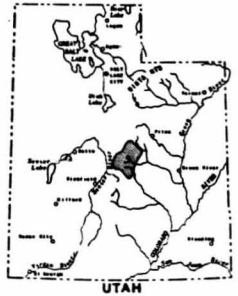
Progress: The operation of 19 gaging stations (12 began in August 1978, 4 added in 1979, and 3 added in 1980) by a private contractor (Morrison-Maierle, Inc.) continued into 1981. Data on flow, water quality, suspended sediment, bed material, bacteria, and benthic invertebrates were collected during the 1980 water year. Discharge measurements were made at an additional 60 sites in August and at 74 sites in October 1980 to define losing and gaining reaches of streams; water from 15 of the sites was sampled in August for chemical analysis. Periodic streamflow measurements were made and water samples collected and analyzed by the Geological Survey for quality control. An interpretive report was prepared using data from the 1979 water year. All data were prepared for inclusion in the Geological Survey report "Water Resources Data for Utah" for the 1979 and 1980 water years. New specifications were used for water sampling and analysis during the 1981 water year.

Plans for Next Year: Seven stations will be operated directly by the Geological Survey in the Wasatch Plateau, Book Cliffs, and Emery coal fields. All data will be analyzed, quality control will be maintained, and field investigations will be carried out to document any changes in the hydrologic system. The adequacy of the program to monitor the effects of coal mining will undergo further evaluation. An interpretive report covering the 1980-81 water years will be prepared by May 1982.

Reports:

Lines, G. C., and Plantz, G. G., 1981, Hydrologic monitoring in coal fields of central Utah, August 1978-September 1979: U.S. Geological Survey Water-Resources Investigations 81-138.

CURRENT PROJECT



Title and Number: HYDROLOGY OF THE CENTRAL WASATCH PLATEAU, SANPETE, SEVIER, AND EMERY COUNTIES; UT 78-135-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: T. W. Danielson, Project Chief
D. A. Sylla, Hydrologist
Other District personnel as assigned

Period of Project: June 1978 to September 1981

Objectives: The purpose of this investigation is to provide hydrologic information for the central Wasatch Plateau so that the Bureau of Land Management can make reasonable stipulations in future coal leases to minimize the disturbance of the hydrologic system and sources of water supply. The specific objectives of this study are: (1) Define the extent and characteristics of aquifers above, within, and immediately below the coal-bearing sections of the Blackhawk Formation. Also define areas of aquifer recharge and discharge and the quantity and quality of water held in storage in each aquifer. (2) Determine the existing seasonal variation in the quantity and quality of surface water and stream aquatic life. (3) Estimate volumes of runoff and peak flows from 10- and 25-year, 24-hour storms and the peak runoff from the 2- and 100-year storms. Also map areas inundated by the 100-year flood. (4) Determine the location and sources of water supply for significant domestic, agricultural, industrial, and other uses. Identify municipal watersheds and aquifers that are the sole source of supply for public use. Determine the existing seasonal variability in quantity and quality for the major sources of supply. (5) Where possible, predict the effects of underground-coal mining and associated surface facilities on the quantity and quality of surface and ground water and stream aquatic life, with emphasis on aquifers and watersheds that are the sole source of a public-water supply.

Approach: Hydrologic data were collected during coal-exploration drilling by Federal, State, and private organizations. Observations of water-level fluctuations and, where possible, sampling was conducted in all cased holes. Further knowledge of the ground-water system was obtained from a spring inventory and sampling program. Seepage runs were made on the major streams. Flood peaks and volumes were estimated for various recurrence intervals using Water Resource Council guidelines. Multiple-regression techniques were then used to relate basin characteristics to both flood peaks and volumes. Aquatic-biota surveys and surface-water sampling for chemical quality and sediment were also conducted.

Progress: Fieldwork, including spring inventory and sampling, was completed. Final interpretive report and basic-data report have been prepared and are in review.

Plans for Next Year: None.

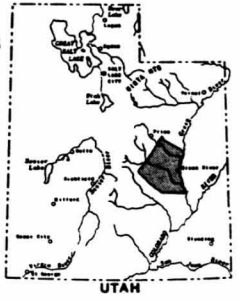
Reports:

Danielson, T. W., and Sylla, D. A. (in review), Selected hydrologic data, Wasatch Plateau, central Utah, 1977-80: U.S. Geological Survey Open-File Report (Hydrologic-Data Report).

Danielson, T. W., and Sylla, D. A. (in review), Hydrology of the Wasatch Plateau coal-resource area, central Utah: U.S. Geological Survey Water-Supply Paper.

CURRENT PROJECT

Title and Number: **WATER IN BEDROCK IN THE NORTHERN SAN RAFAEL SWELL AREA, EMERY AND CARBON COUNTIES, WITH SPECIAL EMPHASIS ON THE NAVAJO SANDSTONE; UT 78-136-C**



Cooperating Agency: Utah Division of Water Rights

Staff: J. W. Hood, Project Chief
D. J. Patterson, Hydrologic Technician

Period of Project: July 1978 to June 1981

Objectives: Determine or estimate so far as possible: (1) Potential well yields of the pre-Mancos Shale formations; (2) the long-term capability of the aquifers to sustain yields of water of usable chemical quality; and (3) the probable effects of ground-water withdrawals on the surface-water supply of the Colorado River system. Implicit in these objectives is a general definition of the hydrologic system in the project area.

Approach: Definition of the hydrologic system will use the procedures of general areal studies, including accumulation of existing hydrologic and geologic data, and the use of existing base maps and geologic maps with minor modifications made in the field.

No surface-water gaging network is planned; concurrent and previous data will be used. Miscellaneous streamflow measurements and sampling will be done only in selected areas that may provide data significant to the ground-water evaluation.

The distribution, thickness, and structural attitude of aquifers will be evaluated from existing geologic maps, photogeology, and the relatively abundant data from oil-test holes and other mineral-exploration records.

The ability of the aquifers, such as the Navajo Sandstone, to take in, store, and discharge ground water will be evaluated from any well tests that can be run. Such tests will be supplemented by other tests, possibly including outcrop tensiometer installation, ring-infiltrometer tests, and laboratory tests of rock specimens for hydraulic conductivity and porosity. The data obtained will be used in a generalized digital-computer model for evaluating general conclusions and computations. Construction of a detailed predictive model is considered unrealistic, owing to the lack of data.

Existing chemical analyses of ground water will be supplemented with selective sampling. In general, only the common dissolved constituents will be determined and evaluated for utility of the water, but some minor or trace elements may be determined for the purpose of interpreting interformational movement of water.

Progress: Planned routine observations and data collection were terminated on September 30, 1980. Supplemental funds were made available for test drilling and other testing, which was carried out mainly in June-August 1980. Six test holes ranging from 200 to 700 feet in depth were drilled. One of the six was abandoned because of lost circulation; two holes flowed and were tested by setting packers. One hole was entirely dry in the Navajo Sandstone. In addition to test drilling, two existing petroleum test holes were re-entered, and one was gun-perforated in order to obtain potentiometric-surface data.

After test drilling was completed, final report preparation began. Concurrently, the preliminary digital model of the project area was modified to incorporate all the project data; the model was tested in several ways and approximately 50 computer runs were made of the model.

The final report, including tables of basic data, was completed and reviewed for technical content.

The Navajo Sandstone, within the project area of 2,880 square miles, contains an estimated 42 million acre-feet of fresh to moderately saline water. Recharge to and discharge from the sandstone aquifer is estimated to average only 3,000 acre-feet per year. Long-term, large-scale withdrawals from the Navajo are not feasible; moderate withdrawals, especially west of the San Rafael Swell, are feasible if the wells are widely spaced. Long-term moderate withdrawals would have a negligible effect on the flow of the Colorado River.

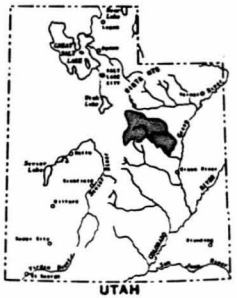
Plans for Next Year: None.

Reports:

Hood, J. W., and Patterson, D. J. (in review), Bedrock aquifers in the northern San Rafael Swell area, Utah, with special emphasis on the Navajo Sandstone: Utah Department of Natural Resources and Energy Technical Publication.

CURRENT PROJECT

Title and Number: HYDROLOGY OF THE PRICE RIVER BASIN, WITH EMPHASIS ON AREAS UNDERLAIN BY COAL; UT 79-138-I



Cooperating Agency: U.S. Bureau of Land Management

Staff: K. M. Waddell, Project Chief
J. E. Dodge, Hydrologic Technician
D. W. Darby, Hydrologic Technician (part time)
S. M. Theobald, Hydrologic Field Assistant (part time)

Period of Project: October 1978 to September 1981

Objectives: To determine the effects of present and proposed coal mining on the hydrology of the Price River basin. Specifically, to determine the effects of coal mining (including the effects of existing and potential land subsidence) on surface-water quantity, quality, and biology; ground-water recharge, movement, discharge, and quality; and sediment yields.

Approach: Study the occurrence of ground water in the basin including recharge, movement, discharge, and aquifer properties. Evaluate surface-water supplies, including variability of streamflow, flood-prone areas, biological characteristics, and sediment yields. Determine surface water-ground water relationships and the chemical characteristics of ground and surface water, including Scofield Reservoir. Study the occurrence of water in existing coal mines and evaluate the effects of mining on the hydrologic system.

Progress:

1. Made aquatic-biota survey at 14 sites during July and October 1980.
2. Collected bed-material samples at benthic-invertebrate sampling sites.
3. Conducted bathymetric, and bottom-core surveys in Scofield Reservoir.
4. Collected water-quality information on all streams flowing into and out of Scofield Reservoir during low flow of snowmelt-runoff periods.
5. Monitored discharge of springs in the Soldier Creek and Scofield Reservoir areas during May-October, 1980.
6. Operated continuous-record gages on two streams in the Scofield area and established rating curves with frequent measurements during snowmelt-runoff period.
7. Operated continuous-record gage on spring flow in Clear Creek.
8. Conducted detailed seepage studies along relocated stream reaches.
9. Collected multiple water-quality samples of snowmelt runoff for selected streams in the Scofield area.

Plans for Next Year: Complete preparation of basic-data and two interpretive reports.

Reports:

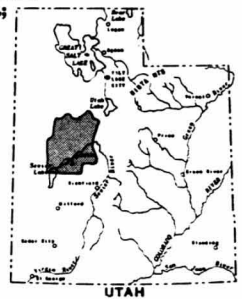
Waddell, K. M., Dodge, J. E., Darby, D. W., and Theobald, S. M. (in preparation), Selected hydrologic data, Price River basin, Utah, water years 1979 and 1980: U.S. Geological Survey Open-File Report (Hydrologic-Data Report).

_____ (in preparation), Hydrology of the Price River basin, Utah with emphasis on selected coal-field areas: U.S. Geological Survey Water-Supply Paper.

Waddell, K. M., and Darby, D. W. (in preparation), Chemical and physical characteristics of water and sediments in Scofield Reservoir: U.S. Geological Survey Water-Supply Paper.

CURRENT PROJECT

Title and Number: GROUND-WATER CONDITIONS IN THE SEVIER DESERT, WITH PREDICTIONS OF THE EFFECTS OF FUTURE WITHDRAWALS USING A DIGITAL-COMPUTER MODEL; UT 79-139-C



Cooperating Agency: Utah Division of Water Rights

Staff: W. F. Holmes, Project Chief
M. Enright, Hydrologic Technician
D. E. Wilberg, Hydrologic Field Assistant (part time)
Other District personnel as assigned

Period of Project: July 1979 to June 1982

Objectives: On the basis of early study data obtained since 1962 and using recent analytical techniques, particularly digital-computer modeling, update information on and revise concepts of the ground-water system, particularly: (1) location, source, and amount of recharge and discharge; (2) rates and direction of the movement of ground water, past, present, and future; (3) amount of ground water of various qualities in storage and the amount recoverable under various pumping schemes; (4) effects of continued present or increased future pumping on ground-water levels; and (5) effects of proposed changes in points of diversion and locations of use of both surface and ground water on the hydrologic system.

Approach: All pertinent ground-water data in the files of Federal and State agencies and private organizations will be put in computer storage. The water-level measurement and pumpage-inventory programs will be increased greatly during the first year to improve definition of the potentiometric surfaces, to determine the accuracy of past pumpage measurements, and to improve the accuracy of future measurements. Aquifer tests will be made and old tests reanalyzed to determine hydraulic coefficients of the several parts of the ground-water reservoir. Geophysical logs will made of all available and suitable wells. A three-dimensional digital-computer model will be the principal tool used in testing and analyzing the hydrologic concepts concerning the ground-water reservoir, including the relationships of the individual aquifers upon each other, effects of various possible levels of future withdrawals, and effects of changes in location of diversion and use of surface and ground water.

Progress: Monthly measurements of water levels at selected observation wells are being made and monthly pumpage data from selected irrigation wells and flowing wells are being collected. Computer storage of ground-water data continued. Measurements were made of discharge at selected springs. The Parshall flume at Clear Lake Springs was checked for accuracy. Grid for the digital model has been designed and drafted. Several aquifer tests have been completed and analysis is underway. About 10 observation wells have been drilled and are being monitored for changes in water level.

Plans for Next Year: Continue data analysis. Prepare basic-data report, model report, aquifer-test report, and final interpretive report.

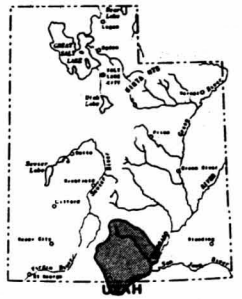
Reports:

Holmes, W. F., and Wilberg, D. E. (in preparation), Results of aquifer test near Lynndyl, Utah: U.S. Geological Survey Open-File Report.

Enright, M., and Holmes, W. F. (in preparation), Ground-water data, Sevier Desert, Utah: U.S. Geological Survey Open-File Report (Hydrologic-Data Report)

CURRENT PROJECT

Title and Number: GROUND-WATER CONDITIONS IN THE KAIPAROWITS AREA, UTAH AND ARIZONA, WITH EMPHASIS ON THE NAVAJO SANDSTONE; UT 79-140-C



Cooperating Agency: Utah Division of Water Rights

Staff: P. J. Blanchard, Project Chief
Other District personnel as assigned

Period of Project: July 1979 to June 1982

Objectives: The study will provide quantitative data about aquifers: extent, thickness, porosity, hydraulic conductivity, transmissivity, storage coefficient, rates of discharge and recharge, directions of ground-water flow, chemical quality of water, and volumes of water of various qualities in storage. The study will be directed mainly at the Navajo Sandstone. It will include determination of actual and potential well yields and qualitative prediction of the effects of increased ground-water use associated with potential coal development and other uses of water. Some supplementary data on surface water will be included. The effects of Lake Powell on the Navajo Sandstone aquifer will be estimated.

Approach: General aquifer characteristics will be determined from available and collected geologic data. Hydraulic characteristics will be determined by aquifer tests, where possible. Additional information will be obtained from geophysical logs and analyses of lithologic samples. Areas of ground-water discharge and recharge will be determined by collation of available hydrologic data and from observations made during the study. Rates of ground-water recharge will be estimated from surface-water seepage measurements and rates of infiltration of precipitation in upland areas. Rates of ground-water discharge will be estimated from well- and spring-discharge data, seepage inflow to streams, and evapotranspiration estimates. Directions of ground-water flow will be determined from a potentiometric surface constructed using water-level data from wells and springs. Chemical analyses of water from selected ground-water sites and related surface-water sources will be used to obtain volumes of water of various qualities in storage. Standard analytical techniques will be used to predict the approximate effects of withdrawing water from the Navajo Sandstone on ground-water levels and stream discharge. Effects of Lake Powell on the Navajo aquifer will be determined from water-level records for wells and aquifer data obtained near the lake.

Progress: Wells tapping the Navajo in Utah have been inventoried and their water levels used in construction of a potentiometric-surface map. Inventory of Arizona Navajo wells and wells in the Entrada Sandstone is in process. Ten observation wells are being monitored monthly. Three short-term aquifer tests have been performed. Four water samples have been collected for cation-anion and heavy-metal analysis. Four shallow cores (three from the Navajo and one from the Wingate Sandstone) have been collected for porosity and permeability determination and grain-size analysis.

Plans for Next Year: Spring inventory, including discharge measurements and water sampling, will be performed. Seepage runs will be performed in both the Paria and Escalante drainages. Additional cores may be collected, and an additional one or two aquifer tests may be performed.

Reports: None.

CURRENT PROJECT

Title and Number: RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATER IN THE WEBER RIVER BASIN; UT 79-141-C

Cooperating Agency: Utah Division of Water Rights

Staff: K. R. Thompson, Project Chief (part time)
Other District personnel as assigned

Period of Project: July 1979 to June 1981

Objectives: The basic objective is to define the general chemical characteristics of surface water in the 2,080-square-mile Weber River basin. Seasonal variations of quality will be identified, and the general effects of natural environment and or water use will be determined. A secondary objective is to define specific problem areas or stream reaches for future intensive investigation.

Approach: Available data from other agencies will be inventoried and compiled. These data, along with information on geology, irrigation, soils, vegetation, mineral development, and runoff, were used as the basis for design of a network of 107 water-quality observation sites. From these sites about 35 were designated as major sampling sites and sampled more frequently. Trace elements, pesticides, and sanitary quality were sampled at selected sites.

Progress: All sampling and chemical analysis have been completed and interpretive report has been prepared.

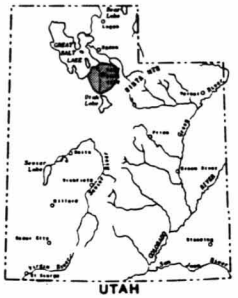
Plans for Next Year: None.

Reports:

Thompson, K. R. (in review), Reconnaissance of the quality of surface water in the Weber River basin, Utah: Utah Department of Natural Resources and Energy Technical Publication.

CURRENT PROJECT

Title and Number: SALT LAKE COUNTY
URBAN RUNOFF;
UT 79-142-C



Cooperating Agency: Salt Lake County Division of
Flood Control and Water Quality

Staff: R. C. Christensen, Project Chief (part time)
D. W. Stephens, Hydrologist (part time)
G. E. Pyper, Supervisory Hydrologic Technician (part time)
H. F. McCormack, Hydrologist (part time)
K. R. Thompson, Hydrologist (part time)
L. S. Conroy, Hydrologic Technician (part time)
R. S. Cahoon, Hydrologic Field Assistant (part time)
L. Armstrong, Technician, Salt Lake County
G. Heal, Technician, Salt Lake County
S. Mitckes, Technician, Salt Lake County
B. Santisteven, Technician, Salt Lake County

Period of Project: September 1979 to August 1982

Objectives: To characterize urban runoff with respect to both quantity and quality and to demonstrate the effectiveness of various management alternatives in reducing pollution loads from urban runoff. Work elements within the study will include: (1) Identification of the impact of urban runoff on the east-side canal system and on the east-side major tributaries to the Jordan River; (2) evaluation, limited to available data, of the effects of modifications to detention and catchment basins on the quality of urban storm water; (3) evaluation, limited to available data, of the effects of wetland flow treatment on water quality; and (4) hydrologic analysis of urban-storm-runoff data collected from a basin for which the cooperator will evaluate the effectiveness of a program of public information/education on practices to improve the quality of urban runoff.

Approach: A system of sampling sites will be established in Salt Lake County to collect concurrent data on precipitation, wet and dry atmospheric fallout, and quantity and quality of urban runoff. These sampling sites (gaging stations) will be on the major Jordan River east-bank tributaries, the main canal systems east of the Jordan River, and at small best-management practice (BMP) basins to characterize urban runoff and to demonstrate the effectiveness of various management alternatives to improve the quality of urban runoff. A consistent set of basin and storm characteristics and environmental practices will be inventoried for each selected basin for use in data analysis and for regional and national transferability. As data are collected, the reliable data will be placed in WATSTORE, statistical analyses will be made to relate storm water-quality constituent loads to basin and storm characteristics and environmental practices.

Progress: An urban data-monitoring system was completed. The data-monitoring system consists of 6 atmospheric wet- and dry-deposition stations, 23 precipitation stations, and 46 streamflow-gaging stations, of which 26 are also water-quality stations. The stations have been operated since they were installed, which varied in time from a full year to just being put in operation at the end of the reporting period. Urban runoff during eight storms, spring runoff, and summer and winter base flows were sampled for suspended sediment, inorganic and organic chemical constituents, and bacteriological indicators. An inventory of basin and storm characteristics and environmental practices was started. A data report was prepared for the water year ending September 30, 1980. The runoff and water-quality data included in the data report were also stored in the WATSTORE computer files.

Plans for Next Year:

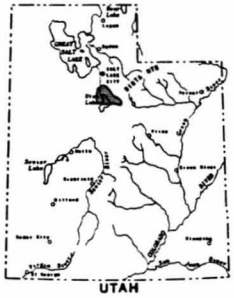
1. Operate and maintain the current urban data-monitoring system through September 30, 1981, after which only a part of the data-monitoring system will be continued through the remainder of the reporting period.
2. Continue the current water-quality sampling of urban runoff from three storms and of summer and fall base flows through September 30, 1981, after which only a part of the water-quality sampling schedule will be continued through the remainder of the year.
3. Complete the inventory of basin and storm characteristics and environmental practices.
4. Process collected data and store in WATSTORE and prepare a data report to include basic data collected during the 1981 water year.
5. Analyze collected data to relate storm water-quality constituents to basin and storm characteristics and environmental practices, and prepare a draft of the final interpretive report.

Reports:

Pyper, G. E., Christensen, R. C., Stephens, D. W., McCormack, H. F., and Conroy, L. S. (in review), Selected surface-water and climatological data, Salt Lake County, Utah, water year 1980: U.S. Geological Survey Open-File Report.

CURRENT PROJECT

Title and Number: GROUND-WATER CONDITIONS IN NORTHERN UTAH VALLEY, WITH PREDICTIONS OF THE EFFECTS OF FUTURE WITHDRAWALS USING A DIGITAL-COMPUTER MODEL; UT 80-143-C



Cooperating Agency: Utah Division of Water Rights

Staff: D. W. Clark, Project Chief
C. L. Appel, Hydrologist
P. E. Fairbanks, Hydrologic Technician (part time)

Period of Project: January 1980 to June 1983

Objectives: On the basis of data obtained since 1963 and using a three-dimensional digital-computer model, determine changes in ground-water levels and quality, and update and revise concepts of ground-water occurrence, particularly: (1) location and amount of recharge from seepage from streams and irrigation, subsurface flow from consolidated rocks, and precipitation; and location and amount of discharge from springs and wells, evapotranspiration, diffuse seepage into Utah Lake, seepage to drains, streams, and sewers, and subsurface outflow into Jordan Valley; (2) predict effects of continued present or increased future pumping on water levels in the four defined aquifers, and estimate effects on the chemical quality of ground water; and (3) estimate, if possible, the effects of potential importation of surface water by the Central Utah Project on the ground-water system.

Approach: All applicable historical data will be compiled and put in computer storage. A field inventory of large wells drilled since 1963 will be completed and an observation-well network will be established, including those wells used in the Statewide observation program, in order to improve definition of the potentiometric surfaces for all four aquifers. Quantification of discharge and recharge will be made from field measurements, pumpage records, and various methods of estimation. Water from selected wells, springs, and surface sources will be sampled for chemical analysis. Aquifer tests will be made to determine hydraulic coefficients and their possible vertical and horizontal variations. Geophysical logs will be made on all available and suitable wells. A water budget will be prepared. A three-dimensional digital-computer model will be designed and calibrated and will be the principal tool used in analyzing hydraulic properties of the ground-water reservoir, relationships of individual aquifers with each other, effects of changes in ground-water withdrawals on water levels, and as a means of qualitatively estimating changes in chemical quality of the water.

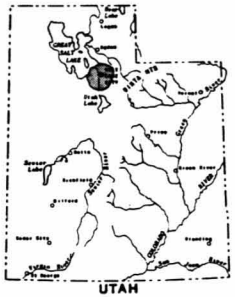
Progress: The well inventory has been completed and an observation-well network designed. Water levels in about 450 wells were measured in March 1981, and water levels are being measured bimonthly in 40 of these wells. The well and water-level data have been submitted to the computer system. Water samples were taken from selected wells to detect possible changes in quality since 1958. A water-quality sampling network was designed and sampling is underway to determine lateral and vertical differences in ground-water quality along with possible quality correlations with bedrock springs and surface water. A method of estimating total ground-water discharge has been adopted and fieldwork is underway including: phreatophyte mapping, installation of shallow water-table wells, and measuring discharge from drains and springs. Well-pump rating and flowing-well discharge measurements continued. Geophysical logging of available wells continued. Geophysical data (aeromagnetic and earth resistivity) have been collected in the northern half of the area. Core drilling of two deep test wells to determine hydrologic and geologic properties of the basin fill is underway. One brief aquifer test has been completed and others are planned. The three-dimensional digital-computer model has been designed, and the calibration under steady-state conditions is near completion.

Plans for Next Year: Continue to make bimonthly measurements of water levels in observation wells, including shallow water-table wells. Measure discharge of selected wells, drains, and springs. Continue to sample wells for water-quality analysis. Make geophysical logs of wells where possible. Conduct aquifer tests. Complete calibration of the three-dimensional model under steady-state conditions. Submit remaining water-level and well data to the computer system. Retrieve data from the system and begin making corrections where necessary. Complete preliminary maps of the potentiometric surface in each aquifer, water chemistry, and phreatophyte distribution.

Reports: None.

CURRENT PROJECT

Title and Number: JORDAN RIVER QUALITY; UT 80-144-F



Staff: R. C. Christensen, Project Chief (part time)
D. W. Stephens, Hydrologist (part time)
K. R. Thompson, Hydrologist (part time)
G. E. Pyper, Supervisory Hydrologic Technician (part time)
H. F. McCormack, Hydrologist (part time)
R. S. Cahoon, Hydrologic Field Assistant (part time)
Other District personnel as assigned

Period of Project: December 1979 to September 1983

Objectives: To provide Jordan River basin planners and managers with sound technical information and methods, based on definition of cause-effect relationships, to use in evaluating impacts of planning alternatives on the water quality of the Jordan River.

Approach: Determine, in conjunction with concerned city, county, State, and Federal agencies, water-quality problems of the Jordan River that should be evaluated during the study. Determine the river hydrologic characteristics. Select applicable evaluation methods to assess water-quality problems. Review available data and consider the data that will be provided by the Urban-Runoff Study, then plan necessary field and laboratory programs to collect additional data at the intensity appropriate to adequately assess the problems. Analyze the data and formulate the evaluation method to provide predictive capability for each problem. Forecast the impacts of planning alternatives on each problem.

Progress: The evaluation of the existing and potential water-quality problems of the Jordan River was completed. Of the water-quality problems identified in conjunction with concerned Federal, State, and local agencies; toxic substances, dissolved-oxygen depletion, sanitary quality, and turbidity-suspended sediment were chosen for study in this project. A detailed work plan on data collection and analysis was prepared for each of the four water-quality problems. Water-quality sampling was coordinated with the Urban-Runoff Study (UT-142). Streamflow and water-quality data collected through September 30, 1980, were included in a data report prepared for the Urban-Runoff Study (UT-142). Began to determine the hydrologic characteristics of the Jordan River for use in understanding the chemical and biological processes occurring in the river.

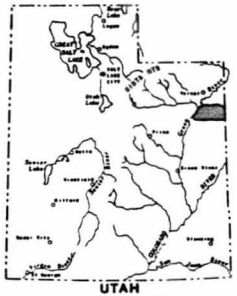
Plans for Next Year:

1. The Salt Lake County Division of Flood Control and Water Quality will become the cooperating agency beginning October 1, 1981.
2. Continue field and laboratory data-collection programs to adequately assess river water-quality problems of toxic substances, dissolved-oxygen depletion, sanitary quality, and turbidity-suspended sediment.
3. Make preliminary graphical correlations of problem constituents with other constituents and river parameters such as river mile, depth, discharge, etc., to develop cause-effect relationships.
4. Make seepage runs to determine the quantity and quality of ground-water inflow into the Jordan River.
5. Obtain cross sections of the Jordan River for defining hydrologic characteristics of the river and to satisfy requirements for water-quality modeling.
6. Make time-of-travel studies for the Jordan River under low-, moderate-, and high-flow conditions.
7. Calibrate and verify water-quality models to be used in making simulation runs on forecasting impacts of planning alternatives on the Jordan River.
8. Prepare streamflow and water-quality data collected during the 1981 water year for publication in the data report for the Urban-Runoff Study (UT-142).

Reports: None.

CURRENT PROJECT

Title and Number: TRACE-ELEMENT TRANSPORT ON SUSPENDED SEDIMENT OF THE SOUTHEASTERN UINTA BASIN; UT 81-145-F



Staff: B. A. Kimball, Project Chief

Period of Project: October 1980 to September 1981

Objectives: Determine the mode of transport of trace elements on suspended sediment, and suggest which trace elements might pose a health hazard if oil-shale development proceeds in the Uinta Basin.

Approach: The study involves separating suspended-sediment samples into sand, silt, and clay fractions, then determining the trace elements present as exchangeable ions, as bound ions by organic and metal-hydroxide coatings, and as part of the sediment-particle structure. These different modes of transport reflect varying degrees of availability to the environment.

Progress: Sample collection and laboratory analysis have been completed. The experimental data are being analyzed by a chemical equilibrium model and also by multivariate factor analysis.

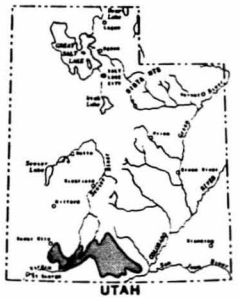
Plans for Next Year: None.

Reports:

Kimball, B. A. (in preparation), Trace-element transport on suspended sediment of the southeastern Uinta Basin, Utah: U.S. Geological Survey Open-File Report (to be submitted for publication in a technical journal).

CURRENT PROJECT

Title and Number: HYDROLOGY OF THE KAIPAROWITS, ALTON, AND KOLOB COAL FIELDS, SOUTHERN UTAH
UT 81-146-I



Cooperating Agency: U.S. Bureau of Land Management

Staff: G. C. Lines succeeded by D. A. Sylla, Project Chief (part time)
J. L. Steiger, Hydrologic Technician (part time)
D. W. Darby, Hydrologic Technician (part time)

Period of Project: October 1980 to September 1983

Objectives: The main objective of the study is to define the hydrologic system, namely the seasonal variations in surface-water quantity and quality and the extent, characteristics, and recharge-discharge relationships of aquifers above, within, and directly below coal-bearing rocks. The second objective is to predict qualitatively, where possible, the effects of coal mining on the water resources.

Approach: Standard techniques of hydrologic investigations will be used, including: a thorough literature and file search for existing data, flow measurements and sampling of surface water to define seasonal variations, an extensive well and spring inventory, inventory of present mining and water production in the area, observations of water-level fluctuations in wells, aquifer tests to determine aquifer coefficients, base-flow measurements on streams to determine gaining and losing reaches, and perhaps radioisotope or fluorocarbon dating of ground water.

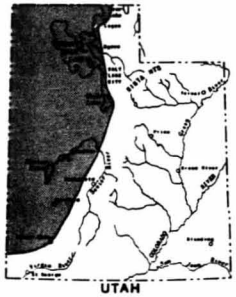
Progress: A planning document and work plan have been prepared. A file and literature search of all existing data has been completed. A base map has been completed, and existing data sites have been plotted on the map. A geologic map has been compiled. Fieldwork has begun with the collection of surface-water samples in April 1981.

Plans for Next Year: To define seasonal variation, the surface-water sampling probably will continue on a semiannual basis through the first 2 years of the study. The well and spring inventory will begin and, if possible, wells will be located that are suitable for aquifer tests, logging, and periodic measurements of water levels. Several springs will be selected for periodic measurements of discharge to qualitatively define storage properties of aquifers. If possible, observation wells will be constructed using test holes drilled for coal exploration by private companies and government agencies. Base-flow measurements will be made in the fall on selected streams to define gaining and losing reaches and the relationship between ground and surface water.

Reports: None

CURRENT PROJECT

Title and Number: GREAT BASIN REGIONAL AQUIFER SYSTEMS ANALYSIS; UT 81-147-F



Staff: J. S. Gates, Project Chief (part time)
J. L. Mason, Hydrologist
P. L. Buettner, Hydrologic Field Assistant (part time)
R. T. Green, Hydrologic Field Assistant (part time)

Period of Project: October 1980 to October 1984

Objectives: This study will be one in a series of national studies of regional aquifer systems that together will cover much of the United States. The Great Basin study will be headquartered in Carson City, Nevada, with part of the work located in the Utah District office. The overall objective is to assemble hydrologic information and create predictive capabilities necessary for effective management. The Great Basin is made up of individual basins that have alluvial-fill aquifers of similar origin, but these aquifers are either not connected hydrologically or have limited connection, sometimes by way of consolidated-rock aquifers underlying the uplands that separate basins. Specific objectives will be to establish common principles governing occurrence, recharge, movement, discharge, and quality of water in the aquifers of the Great Basin, and to construct digital-computer ground-water models of representative basins or groups of hydrologically connected basins. The models will be used to help understand the natural (pre-development) flow and geochemical systems and to predict effects of future development and differences in the effects of various management strategies.

Approach: Computer simulation will be the main tool used to analyze the existing hydrogeologic regime and to provide the capabilities of predicting the effects of future development. The simulations will incorporate hydraulic effects, and where necessary and feasible, such associated effects as solute transport and land subsidence. Simulation will be initiated early in the study to help determine the overall nature of the flow system, to identify sensitive parameters and data needs, and to determine what segments of the system, if any, can be treated independently. Assembling available hydrogeologic data on the Great Basin will be an important part of the work, and collection of new data needed for successful simulation may require fieldwork. The present distribution of water quality throughout the area will be described using available and project-collected data. These data will be used to interpret the water-quality distribution in terms of the original flow pattern and geochemical processes, and an effort will be made to predict water-quality changes in response to future development, waste disposal, or artificial recharge.

Progress: Maps and tables have been compiled for the Utah part of the Great Basin, using available data and data obtained from Air Force contractors making MX-Missile siting studies, showing water levels, depth to water, major springs, ground-water discharge, hydrologic-data sites for and preliminary definition of consolidated-rock aquifers, and flow-system definition. A bibliography was prepared of hydrogeologic studies in the area. Plans were prepared defining methods to use in making monthly measurements of discharge and chemical quality of major springs. Water levels were measured in February-March in the Jordan Valley and the Milford area and potentiometric-surface maps prepared. A pumpage inventory of the Milford area during the 1981 irrigation season was begun. Material was provided to the Nevada District for inclusion in the project planning document.

Plans for Next Year: Complete all data-compilation maps. Make monthly measurements at major springs and sample for isotope analyses. Complete pumpage inventory in the Milford area. Prepare specifications for a series of geophysical surveys to be made in Tule Valley. The surveys will obtain data which will be used to interpret thickness and lithology of basin fill and to estimate hydrologic parameters for a digital model. Begin design and construction of a digital model of the Milford area. Assist personnel the of Jordan Valley study in design of an aquifer test or a shallow test-drilling program. Make a field inventory of all wells drilled during MX-Missile siting studies. Collect and classify water-quality data from non-USGS sources.

Reports: None

CURRENT PROJECT

Title and Number: FLOOD-PLAIN MAPPING IN BLM-ADMINISTERED LANDS IN UTAH, WITH EMPHASIS ON COAL-LEASE AREAS; UT 81-148-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: K. L. Lindskov, Project Chief (part time)
B. E. Thomas, Hydrologist
E. J. Whitney, Hydrologic Field Assistant (part time)

Period of Project: October 1980 to September 1982.

Objectives: Provide methods for delineating flood plains that the Bureau of Land Management can use to formulate land-use plans and enforce Public Law 95-87, the Surface Mining Act. Describe the hydraulic and hydrologic factors that must be considered when preparing flood-plain maps. Complete a manual outlining procedures for flood-plain mapping, including preparation of profiles of historic floods and profiles of theoretical floods, and discussion of Federal Insurance Administration Studies and "quick and dirty" techniques.

Approach: (1) Review existing techniques for outlining areas inundated by floods of selected return periods. (2) Update regional flood-frequency relations in order to more accurately predict peak flows for selected return periods. (3) Develop regional relations between flood depth for selected return periods, basin characteristics, and channel geometry. (4) Prepare a manual outlining standardized procedures for delineating flood plains.

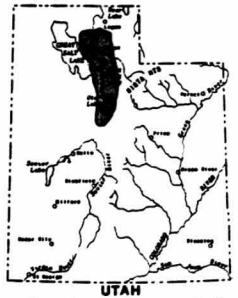
Progress: Work for items 1-3 as outlined above is almost complete.

Plans for Next Year: Complete all interpretive work and finish draft of final report by June 1, 1982.

Reports: None.

CURRENT PROJECT

Title and Number: GROUND WATER IN UTAH'S RAPIDLY GROWING WASATCH FRONT AREA; UT 81-149-F



Staff: Don Price, Project Chief (part time)
Other District personnel as assigned

Period of Project: April 1981 to September 1981

Objective: To describe in nontechnical language the ground-water resource of the Wasatch Front area between Manti and Brigham City.

Approach: This is an "Information-Transfer" project funded by the U.S. Geological Survey's Earth Science Applications Program. It is designed to transfer technical information to nontechnical planners and managers in a language they can understand. This is done through well-illustrated lay-reader reports and/or information-transfer workshops. For this project, a lay-reader report will be compiled that describes the ground-water resources of the Wasatch Front from the standpoint of sources, general conditions of occurrence, availability, quality, development, and problems. An information-transfer workshop may be conducted depending on interest and availability of personnel to conduct the workshop.

Progress: An annotated outline for the lay-reader report has been prepared. A base map is being compiled. Maps showing information about basin-fill aquifers, ground-water levels, and ground-water quality in the central and northern parts of the area have been completed. Additional ground-water data have been collected but not yet compiled for report presentation.

Plans for Next Year: Because of the late start on this project, the report preparation and review will have to be completed during the next fiscal year without funding.

Reports: None.

CURRENT PROJECT

Title and Number: HYDROLOGY OF AREAS 56 AND 57, ROCKY MOUNTAIN COAL PROVINCE, UTAH, COLORADO, AND ARIZONA; UT 81-151-F

Staff: G. C. Lines, Project Chief (part time)
Other District personnel as assigned

Period of Project: February 1981 to September 1984

Objectives: To describe the hydrology of Area 56 (the Wasatch Plateau, Book Cliffs, Emery, and Henry Mountains coal fields) and Area 57 (the Kaiparowits Plateau, Alton, and Kolob coal fields) in clear and concise reports that can be used by both the coal-mining industry and regulatory government agencies.

Approach: (1) A topic outline will be prepared for each report area. Topics will be assigned to District hydrologists for data analysis and writing based on discipline specialties. (2) For each topic, all available hydrologic information will be assembled, summarized, and interpreted as needed; no new data will be collected. (3) Each topic will be discussed in a text not to exceed one page, accompanied by maps, graphs, and tables as needed (STOP format). The report for Area 56 will be submitted for approval by September 30, 1982; the report for Area 57 will be submitted by September 30, 1983.

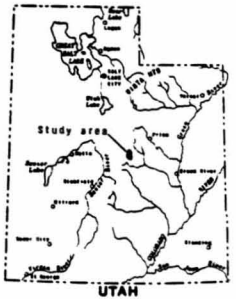
Progress: The topic outline for the report for Area 56 has been prepared and base maps are in preparation.

Plans for Next Year: Assemble, summarize, and interpret all available hydrologic information and prepare report for Area 56.

Reports: None.

CURRENT PROJECT

Title and Number: GROUND-WATER CONDITIONS IN THE TRAIL MOUNTAIN COAL-RESOURCE AREA, CENTRAL UTAH; UT 81-152-I



Cooperating Agency: U.S. Bureau of Land Management

Staff: G. C. Lines, Project Chief (part time)
Other District personnel as assigned

Period of Project: March 1981 to September 1983

Objectives: (1) Determine aquifer characteristics, recharge-discharge relationships, hydraulic connection between aquifers and with streams, and chemical quality of water in water-bearing zones within, above, and immediately below coal in the Blackhawk Formation. (2) Predict, quantitatively where possible, the effects of underground coal mining on the ground-water system, including ground-water discharge to streams.

Approach: (1) Nine coal-exploration holes will be completed as observation and test wells; most wells will tap multiple water-bearing zones and will be tested with expandable packers in order to define differences in aquifer characteristics, water quality, and head with depth in the ground-water system. (2) An extensive spring inventory will be made. (3) Base flow along streams will be measured. (4) Hydraulic conductivity and porosity of representative core samples from aquifers and confining beds will be determined in the laboratory. (5) Surface and ground water will be sampled for chemical analysis. (6) A digital-computer model of the ground-water system will be constructed and calibrated and used to make semiquantitative predictions of effects of underground mining on the system.

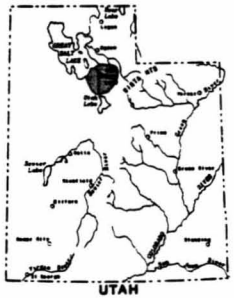
Progress: Data and literature search is complete. Specifications have been prepared to complete nine coal-exploration holes to be drilled by the Conservation Division of the U.S. Geological Survey during the summer and fall of 1981.

Plans for Next Year: Complete nine test holes as wells and prepare contract specifications for testing. Begin the spring inventory, base-flow measurements along streams, and sampling of surface and ground water for chemical analysis. Submit core samples for laboratory determinations of porosity and hydraulic conductivity.

Reports: None.

CURRENT PROJECT

Title and Number: ATMOSPHERIC INPUT TO QUALITY OF URBAN RUNOFF IN SALT LAKE COUNTY; UT 81-153-F



Staff: D. W. Stephens, Project Chief (part time)
Other District personnel as assigned

Period of Project: May 1981 to September 1982

Objectives: To identify the major constituents in wet-fall and dry-fall in Salt Lake County, estimate the loading potential of these constituents to water in storm drains and streams, and determine correlation between quality of atmospheric deposition and runoff.

Approach: Determine the quality and quantity of atmospheric deposition through a network of precipitation gages and atmospheric-deposition collectors. Combine these data with data from storm-water sampling conducted under the Urban-Runoff Study (UT-142) and analyze the results for correlations and trends.

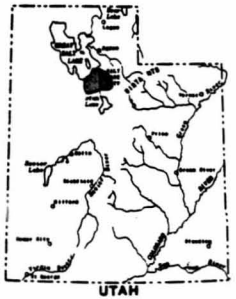
Progress: (1) Precipitation gages have been established or data are available for 22 sites in Salt Lake County. (2) Atmospheric collectors have been installed at six sites with two sites fully functional for wet- and dry-fall. (3) Chemical analyses have been completed on six dry-fall samples and five storm-related wet-fall samples.

Plans for Next Year: (1) Complete electrical connection of collectors, monitor dry-fall on a monthly basis, and monitor wet-fall on four to six storms. (2) Compare precipitation quality derived from atmospheric-collector data and water quality of storm runoff to determine possible correlations.

Reports: None.

PROPOSED PROJECT

Title: GROUND-WATER CONDITIONS IN JORDAN VALLEY, WITH ANALYSIS BY FLOW AND SOLUTE-TRANSPORT MODELS



Cooperating Agencies: Utah Division of Water Rights; local water-management agencies and municipalities

Staff: K. M. Waddell, Project Chief
R. L. Seiler, Hydrologist
Other District personnel as assigned

Period of Project: July 1981 to June 1985

Objectives: (1) To determine the current state of the Jordan Valley's ground-water system in terms of water levels, recharge, movement, discharge, water quality, and volumes of water of various qualities in storage; (2) to construct digital-computer models of the system that will be able to simulate ground-water flow and transport of dissolved solids; and (3) to determine, at least in a preliminary sense, the potential for land subsidence related to water-level declines.

Approach: (1) Update files of data on water levels, withdrawals and natural discharge, and water quality; (2) supplement available information with additional data collected on water levels and quality, recharge and discharge, aquifer and confining-bed parameters, and water in storage; (3) construct a three-dimensional digital model of the system to simulate ground-water flow and several cross-section solute-transport models to simulate movement of dissolved solids. Use the models to simulate changes in water levels and chemical quality resulting from potential ground-water development; and (4) publish results as a Utah Department of Natural Resources and Energy Technical Publication.

Plans for Next Year: Prepare a planning document for the study. Begin updating data files—tabulate wells drilled since 1968-69 and inventory selected wells in the field. Check compilations of pumpage data prepared since 1968 and obtain additional data if needed. Tabulate chemical analyses of ground water made since 1968, and design a sampling program to obtain data for evaluating the current state of the system and for future solute-transport modeling. Compile data on aquifer tests made since 1968. Design a data-collection program to update and improve the valley's ground-water budget. Evaluate the observation-well network and modify as necessary. Collect existing data on the valley's shallow water table and design an augering and shallow observation-well construction program to better define the water table. Plan a comprehensive aquifer test to determine vertical hydraulic conductivities.

PROPOSED PROJECT

Title: RECONNAISSANCE OF THE CHEMICAL QUALITY OF SURFACE WATER OF THE VIRGIN RIVER BASIN

Cooperating Agency: Utah Division of Water Rights

Staff: K. R. Thompson, Project Chief (part time)
G. W. Sandberg, Hydrologist (part time)
Other District personnel as assigned

Period of Project: July 1981 to June 1983

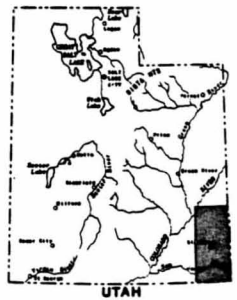
Objectives: The basic objective is to define the general chemical characteristics of surface water in the 5,090-square-mile Virgin River basin terminating at Littlefield, Arizona. A secondary objective is to define specific problem areas or stream reaches for future intensive investigation.

Approach: Available data will be inventoried and compiled. These data, along with information on geology, irrigation, soils, vegetation, mineral development, and runoff will be used as the basis for design of a network of about 100 water-quality observation sites. From these 100 sites about 35 will be designated as major sampling sites and sampled more frequently. Data on the general chemistry of surface water will be obtained seasonally during the period July 1981 to September 1982. Trace-element, pesticide, and bacteriologic data will be collected at selected sites.

Plans for Next Year: Inventory and compile available data. Select water-quality sampling sites and begin data collection.

PROPOSED PROJECT

Title: WATER IN BEDROCK IN EASTERN SAN JUAN COUNTY, WITH SPECIAL EMPHASIS ON THE NAVAJO SANDSTONE AND RELATED AQUIFERS



Cooperating Agency: Utah Division of Water Rights

Staff: C. F. Avery, Project Chief
D. J. Patterson, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: July 1981 to June 1984

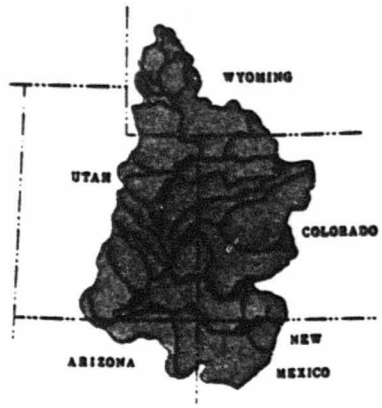
Objectives: To determine: (1) occurrence of ground water and its quality in the area, (2) potential yields of water from wells in the major aquifers, (3) whether those yields can be sustained for the production of fresh or otherwise usable water, and (4) what effect sustained, large, well withdrawals will have on water levels and water in the Colorado River.

Approach: Define the general hydrologic system using methods of general areal studies and locate all available ground-water data and utilize results of all previous studies. Integrate field operations with proposed Upper Colorado River Basin RASA where possible. Concentrate field-data collection on determining recharge and discharge rates, aquifer coefficients, the potentiometric surface, and ground-water quality. Preliminary digital-computer modeling of the aquifer will be used to guide data acquisition and refined modeling will help assess effects of withdrawals.

Plans for Next Year: Prepare detailed project planning document. Compile available data and concurrently begin design of ground-water flow model. Begin field work.

PROPOSED PROJECT

Title: REGIONAL AQUIFER SYSTEMS ANALYSIS-
MESOZOIC SANDSTONE AQUIFERS IN THE
UPPER COLORADO RIVER BASIN



Staff: J. W. Hood, Project Chief
Vacancy, Hydrologist
B. A. Kimball, Hydrologist (part time)
Vacancy, Hydrologist
D. J. Patterson, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: October 1981 to September 1985

Objectives: This study will be one in a series of national studies of regional aquifer systems that together will cover much of the United States. In the Upper Colorado River Basin, aquifers that are truly regional are the complex of thick sandstones of Jurassic and Triassic age and carbonate and sandstone aquifers of Mississippian and Permian age. This study will target the thick sandstones of the Mesozoic System and locally related aquifers of lesser extent. The study is intended to (1) provide a basin-wide data base; (2) define and quantify recharge, occurrence, movement, discharge, and quality of ground water; (3) model the system(s) in order (a) to understand the natural (pre-development) flow and geochemical system(s) and (b) to evaluate or predict the effects of future development and differences in these effects due to various management strategies.

Approach: Computer simulation will be the main tool used to analyze the hydrogeologic regimen of the Mesozoic aquifers system. The results of prior spot, areal, and regional studies will be collected and combined, and basic data from those studies will be updated. Concurrently, a preliminary regional flow model(s) will be constructed in order to test provisional hypotheses and show areas where additional data are needed. Following will be a period of data collection, during which the model(s) will be updated as field data are obtained. Final analyses will incorporate consideration of the effects of development on the ground-water flow regimen and storage, on surface-water flow, and on possible water-quality changes that would accompany development. Results of the study will appear as a planning document, data report(s), model documentation, and a final interpretive report.

Plans for Next Year: Prepare detailed project planning document. Assemble and compile existing hydrologic data and interpretations. Adapt existing base maps (generally adequate). Begin construction of preliminary ground-water digital model.